METHOD AND APPARATUS FOR PROVIDING MEDIA COMMUNICATION SETUP STRATEGY IN A COMMUNICATION NETWORK

FIELD

[0001] The present invention relates to point to point or point to multi-point communications systems. More specifically, the present invention relates to methods and apparatus for providing uniform media communication setup strategy for a group of users operating on different infrastructures within a group wireless communication network.

BACKGROUND

[0002] A class of wireless services intended for quick, efficient, one-to-one or one-to-many (group) communication has existed in various forms for many years. In general, these services have been half-duplex, where a user presses a "push-to-talk" (PTT) button on a phone/radio to initiate a group communication. If granted the floor, the talker then generally speaks for a few seconds. After the talker releases the PTT button, other users who are available may request the floor. These services have traditionally been used in applications where one person needs to communicate with a group of people, such as field service personnel or taxi drivers, generally known as group communication services.

[0003] The members of a group communication session may operate on different types of wireless infrastructures, which may have different setup time requirements. One requirement of group communication services is to provide uniform media communication setup time regardless of the types or versions of infrastructures the group members are operating on.

[0004] There is a need, therefore, for mechanisms to selectively provide uniform media communication setup strategy for a group of users operating on different infrastructures in a group wireless communication network.

SUMMARY

[0005] The disclosed embodiments provide novel and improved methods and apparatus for providing group media communication to a group of users operating on diverse infrastructures in a wireless communication network. In one aspect, the method and

apparatus provides for: receiving a request from an originator for media communication to at least one target, determining the types of infrastructures on which the originator and the target are operating on, and providing a group media communication setup strategy for the originator based on the determined types of the infrastructures.

[0006] In one aspect, the methods and apparatus provides for: allowing an originator to start media communication to a group of users operating on diverse infrastructures in a wireless communication network. The methods and apparatus provides for receiving an indication from an originator desiring to communicate media to at least one target, sending a request to a group communication server, receiving a group media communication setup strategy from the group communication server based on types of infrastructures on which the originator and the target are operating on, and allowing the originator to start communicating media based on the received group media communication setup strategy.

[0007] In one aspect, an apparatus for providing group communication setup strategy includes a memory unit, a receiver, a transmitter, and a processor communicatively coupled with the memory unit, the receiver, and the transmitter. The processor is capable of carrying out the above-mentioned methods.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The features and advantages of the present invention will become more apparent from the detailed description of the embodiments set forth below:

[0009] FIG. 1 illustrates a group communications system;

[0010] FIG. 2 illustrates how several communication devices interact with a group communication server;

[0011] FIG. 3 illustrates one embodiment for implementing a wireless communications infrastructure;

[0012] FIG. 4 illustrates a flow diagram for an optimistic media communication setup strategy for a first type of infrastructure;

[0013] FIG. 5 illustrates a flow diagram for a guaranteed media communication setup strategy for a first type of infrastructure;

[0014] FIG. 6 illustrates a flow diagram for an optimistic media communication setup strategy for a second type of infrastructure; and

[0015] FIG. 7 illustrates a flow diagram for a guaranteed media communication setup strategy for the second type of infrastructure.

DETAILED DESCRIPTION

[0016] Before several embodiments are explained in detail, it is to be understood that the scope of the invention should not be limited to the details of the construction and the arrangement of the components set forth in the following description or illustrated in the drawings. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[0017] FIG. 1 illustrates a functional block diagram of a group communication system **100**, for implementing one embodiment. Group communication system **100** is also known as a push-to-talk (PTT) system, a net broadcast service (NBS), a dispatch system, or a point-to-multi-point communication system. In one embodiment, group communication system **100** includes a group communication server **102**, which may be deployed in either a centralized deployment or a regionalized deployment.

[0018] Group communication devices (CDs) **104** and **106**, which may be deployed such as CDMA (e.g., cdma2000) handsets, for example, may request packet data sessions using a data service option. Each CD may use the session to register its Internet Protocol (IP) address with the group communication server to perform group communication initiations. In one embodiment, group communication server **102** is connected to the service provider's packet data service nodes (PDSNs) through service provider's network **116**. CDs **104** and **106**, upon requesting packet data sessions from the wireless infrastructure, may have IP connectivity to group communication server **102** through the PDSNs **114**. Each PDSN may interface to a base station controller (BSC) through a packet control function (PCF) **108** and a network **112**. The PCF may be co-located with the BSC within a base station (BS) **110**.

[0019] A packet data service node may fall in one of several states, e.g., active or connected state, dormant state, and null or inactive state. In the active or connected state, a active traffic channel exists between the participating CD and the BS or BSC, and either side may send data. In the dormant state, no active traffic channel exists between the participating CD and the BSC, but a point-to-point protocol (PPP) link is maintained between the participating CD and the PDSN. In the null or inactive state, there is no active traffic channel between the participating CD and the BSC, and no PPP link is maintained between the participating CD and the PDSN.

[0020] Each one of CDs **104** and **106** may request packet data sessions. As part of establishing a packet data session, each CD may be assigned an IP address. Each CD

may perform a registration process to notify group communication server **102** of the CD's IP address. Registration may be performed using an IP protocol, such as session initiation protocol (SIP) over user datagram protocol (UDP). The IP address of a CD may be used to contact the CD when the corresponding user is invited into or informed of a group communication.

[0021] Once a group communication is established, CDs **104** and **106** and group communication server **102** may exchange media and signaling messages. In one embodiment, media may be exchanged between the participating CDs and the group communication server by using real-time protocol (RTP) over UDP. The signaling messages may also be exchanged by using a signaling protocol over UDP.

[0022] Group communication system **100** performs several different functions in order to operate group communication services. The functions that relate to the user side include user registration, group communication initiation, group communication termination, sending messages to group participants, late join to a group communication, talker arbitration, adding members to a group, removing members from a group, un-registering a member, and authentication. The functions that relate to system preparation and operation include administration and provisioning, scalability, and reliability.

[0023] FIG. 2 illustrates a group communication arrangement **200** for showing how CDs **202**, **204**, and **206** interact with a group communication server **208**. Multiple group communication servers may be deployed as desired for large-scale groups. A user may input her desire to a CD **202**, **204**, **206** to initiate a communication session for exchanging communication media, e.g., data, voice, image, and/or video, with one or more CDs. In one embodiment, the user may first invite the target users(s) before starting to communicate media, by pushing an "invite" or a PTT button on a CD.

[0024] In FIG. 2, when CD **202** has permission to transmit media to other members of the group, CD **202** is known as the originator and may transmit media over an established channel. When CD **202** is designated as the originator, the remaining participants, CD **204** and CD **206**, may not be permitted to transmit media to the group. Accordingly, CD **204** and CD **206** are designated as targets. As described above, CDs **202**, **204**, and **206** are connected to group communication server **208**, using at least one channel. In one embodiment, channels **210**, **212**, and **214** may include a session initiation protocol (SIP) channel, a media-signaling channel, and a media traffic channel.

[0025] FIG. 3 is a simplified block diagram of an embodiment of a base station/base station controller (BS/BSC) **304** and a communication device **306**, which are capable of implementing various disclosed embodiments. For a particular media communication, voice, data, packet data, and/or alert messages may be exchanged between BS/BSC **304** and communication device **306**, via an air interface **308**. Various types of messages may be transmitted, such as messages used to establish a communication session between the base station and the communication device, registration and paging messages, and messages used to control a data transmission (e.g., power control, data rate information, acknowledgment, and so on). Some of these message types are described in further detail below.

[0026] For the reverse link, at communication device **306**, voice and/or packet data (e.g., from a data source **310**) and messages (e.g., from a controller **330**) are provided to a transmit (TX) data processor **312**, which formats and encodes the data and messages with one or more coding schemes to generate coded data. Each coding scheme may include any combination of cyclic redundancy check (CRC), convolutional, turbo, block, and other coding, or no coding at all. The voice, packet data, and messages may be coded using different schemes, and different types of messages may be coded differently.

[0027] The coded data is then provided to a modulator (MOD) **314** and further processed (e.g., covered, spread with short PN sequences, and scrambled with a long PN sequence assigned to the communication device). The modulated data is then provided to a transmitter unit (TMTR) **316** and conditioned (e.g., converted to one or more analog signals, amplified, filtered, and quadrature modulated) to generate a reverse link signal. The reverse link signal is routed through a duplexer (D) **318** and transmitted via an antenna **320** to BS/BSC **304**.

[0028] At BS/BSC **304**, the reverse link signal is received by an antenna **350**, routed through a duplexer **352**, and provided to a receiver unit (RCVR) **354**. Alternatively, the antenna may be part of the wireless operator network, and the connection between the antenna and the BS/BSC may be routed through the Internet. BS/BSC **304** may receive media information and alert messages from communication device **306**. Receiver unit **354** conditions (e.g., filters, amplifies, down converts, and digitizes) the received signal and provides samples. A demodulator (DEMOD) **356** receives and processes (e.g., despreads, decovers, and pilot demodulates) the samples to provide recovered symbols. Demodulator **356** may implement a rake receiver that processes multiple instances of

the received signal and generates combined symbols. A receive (RX) data processor **358** then decodes the symbols to recover the data and messages transmitted on the reverse link. The recovered voice/packet data is provided to a data sink **360** and the recovered messages may be provided to a controller **370**. Controller **370** may include instructions for receiving and sending information, receiving and sending responses to messages, identifying the targets, locating the targets, determining the types of infrastructures the originator and the targets are operating on, determining whether the targets are registered in the group communication system and/or whether at least one target accepts to receive media, providing a setup strategy for the originator, and buffering media. The processing by demodulator **356** and RX data processor **358** are complementary to that performed at remote access device **306**. Demodulator **356** and RX data processor **358** may further be operated to process multiple transmissions received via multiple channels, e.g., a reverse fundamental channel (R-FCH) and a reverse supplemental channel (R-SCH). Also, transmissions may be simultaneously from multiple communication devices, each of which may be transmitting on a reverse fundamental channel, a reverse supplemental channel, or both.

[0029] On the forward link, at BS/BSC **304**, voice and/or packet data (e.g., from a data source **362**) and messages (e.g., from controller **370**) are processed (e.g., formatted and encoded) by a transmit (TX) data processor **364**, further processed (e.g., covered and spread) by a modulator (MOD) **366**, and conditioned (e.g., converted to analog signals, amplified, filtered, and quadrature modulated) by a transmitter unit (TMTR) **368** to generate a forward link signal. The forward link signal is routed through duplexer **352** and transmitted via antenna **350** to remote access device **306**. Forward link signals include paging signals.

[0030] At communication device **306**, the forward link signal is received by antenna **320**, routed through duplexer **318**, and provided to a receiver unit **322**. Receiver unit **322** conditions (e.g., down converts, filters, amplifies, quadrature modulates, and digitizes) the received signal and provides samples. The samples are processed (e.g., despreaded, decovered, and pilot demodulated) by a demodulator **324** to provide symbols, and the symbols are further processed (e.g., decoded and checked) by a receive data processor **326** to recover the data and messages transmitted on the forward link. The recovered data is provided to a data sink **328**, and the recovered messages may be provided to controller **330**. Controller **330** may include instructions for receiving and sending information, receiving and sending responses to messages, providing the type

of infrastructures a communication device is operating on, buffering media, transmitting media to a group communication server, and granting permission to the originator to deliver media.

[0031] One requirement of group media communication services is to provide optimal media communication setup time regardless of the types or versions of underlying wireless infrastructures. The performance of such systems is measured based on Push-to-Talk (PTT) latency and End-to-End Media Latency. PTT latency includes the delay that is realized from the time an originator presses the PTT button on her or his CD to initiate media communication with one or a group of targets and the time the originator receives an indication that the group communication server has granted the originator permission to send media. End-to-end media latency is the delay that is realized between the time the originator begins to deliver media and the time the target(s) receives the originator's media.

[0032] PTT latency includes the delays involved in establishing a communication link between the originator and the group communication server, processing the originator's request for floor, determining the types of the wireless infrastructures each member of the group is operating on, determining a media communication setup strategy, and granting the originator permission to deliver media. The group communication server makes the determination of call set up strategy using one of at least two different methods: guaranteed setup strategy or optimistic setup strategy. In guaranteed setup strategy, the server announces the group media communication to the target(s) specified in the floor request and waits to receive acceptance from at least one target to participate in the group call prior to establishing the group communication and granting permission to the originator to deliver media. In optimistic setup strategy, the server establishes the group communication and grants the originator permission to deliver media after the group communication server has confirmed that the target(s) have a valid registration within the group call system, but prior to contacting the target(s) to confirm their acceptance to participate in the group media communication.

PTT Latency

[0033] To reduce PTT latency, the group communication signaling, such as messages and/or responses, floor-control requests, floor-control announcements, and dormancy wakeup messages, may be transmitted on some available common channels. This eliminates waiting for dedicated traffic channels of the dormant CD to be re-established.

Common channels may be always available, regardless of the state of the participating CDs, and may not require being requested and reassigned each time a group member initiates a group communication. Therefore, the group communication signaling messages may be exchanged even when the participating CDs are dormant. In one embodiment dedicated traffic channels for the originator's CD and targets' CDs may be re-established in parallel.

[0034] In one embodiment, a dormant user A's CD may send a message to the wireless infrastructure over some available reverse common channel, such as reverse access channel and reverse enhanced access channel. The user A's CD may also receive a message on some available forward common channel, such as forward paging channel and forward common control channel. In one embodiment, dormant target CDs may receive dormancy wakeup messages and/or messages on some available forward common channel, such as forward paging channel and forward common control channel.

Short Data Burst Call-Signaling Messages

[0035] In one embodiment, a significant reduction in dormancy wakeup time, and hence in PTT latency, may be achieved through the use of short data burst (SDB) messages, as provided in "TIA/EIA/IS-2000 Standards for cdma2000 Spread Spectrum Systems," hereinafter referred to as "the cdma2000 standard." In one embodiment, SDB messages may be sent over a dedicated active channel, such as the forward fundamental channel (FCH) or forward dedicated common control channel (F-DCCH). SDB messages may also be sent over a common active channel, such as the reverse access channel (R-ACH), reverse enhanced access channel (R-EACH), forward common control channel (F-CCCH), or paging channel (PCH). SDB messages may be transported by radio burst protocol (RBP), which maps the messages onto an appropriate and available active layer channel. Because SDB messages may carry arbitrary IP traffic and may be sent over common active channels, SDB messages provide a mechanism to exchange group communication signaling when participating CDs have no available dedicated traffic channel.

[0036] In one embodiment, media-signaling messages may carry IP datagrams over the reverse link or mobile-originated link. An originator's communication device may signal the group communication server quickly whenever the originator requests the floor and a dedicated reverse traffic channel is not immediately available. Assuming the

originator's CD has released all dedicated traffic channels, the originator's CD may immediately forward the floor-request message over a reverse common channel of a wireless infrastructure, which may relay the floor-request message to the group communication server. For example, either the reverse access channel or the reverse enhanced access channel may be used to send such messages when a dedicated reverse channel is not available. In one embodiment, the originator's CD may transmit a floor-request message to the group communication server as SDB messages.

[0037] The choice of guaranteed setup strategy or optimistic setup strategy depends on the capability of the CDs and/or the types of the infrastructures, e.g., different releases of the CDMA infrastructure, on which the CDs are operating on. For example, when an originator's CD, which is capable of SDB messaging, operates on "type II" infrastructure, which supports SDB messaging, occasionally roams into a "type I" infrastructure, which does not support SDB messaging, the PTT latency is impacted by the originator's traffic channel re-origination time when the roaming originator requests a group communication session with one or a group of targets. In this case, while either optimistic or guaranteed setup strategy may be used, optimistic setup strategy would result in a shorter PTT latency. By choosing an optimum setup strategy, service providers may provide a uniform communication setup experience when users move among different infrastructures and/or the users operate communication devices of different capabilities.

[0038] FIG. 4 and FIG. 5 illustrate optimistic group communication setup strategy and guaranteed group communication setup strategy, respectively, for an ad-hoc group communication where the originator and targets are operating on type I infrastructure, e.g., "Release 0" of the CDMA infrastructure. FIG. 6 and FIG. 7 illustrate optimistic group communication setup strategy or guaranteed group setup communication strategy, respectively, for an ad-hoc group communication where the originator and targets are operating on type II infrastructure, e.g., "Release A" of the CDMA infrastructure.

[0039] FIG. 4 illustrates a flow diagram showing a process for providing a group communication setup strategy, according to one embodiment. A group communication originator user may set up a communication session for communicating media, such as data, text, formatted document, voice, image, and/or video, to a single or a group of target users. The originator who wishes to initiate the communication session for

sending media may select one or more target users, one or more pre-defined groups of target users, or a combination of the two, and press a button, such as a push-to-talk (PTT) button, on his or her CD. The originator may need to wait until a communication session is established and receives permission to start delivering media, based on the type of the infrastructure the originator is operating on.

[0040] In FIG. 4, the originator's CD receives an indication from the originator for setting up a session to communicate media to one or a group of targets, in step **402**. In this embodiment, the originator is operating on type I infrastructure, which does not support SDB messaging. Therefore, the originator's CD may need to set up its traffic channel prior to sending a message to the group communication server. Upon receiving the indication from the originator, the originator's CD starts the process of traffic channel re-origination, in step **404**, and waits until the traffic channel for the originator is up, in step **406**.

[0041] The originator's CD then sends a "floor request" message, in step **408**, to a group communication server for floor control. The group communication server sends an "ACK request" to the originator's CD, in step **410**, acknowledging the receipt of the floor request. The group communication server performs group communication setup tasks including: identifying the targets, locating the targets, determining the types of infrastructures the originator and the targets are operating on, and determining whether the targets are registered in the group communication system and/or whether at least one target accepts to receive media.

[0042] In one embodiment, the group communication server determines the types of the infrastructure supporting a CD based on inputs provided by the CD. The CD may provide information identifying the supporting infrastructure during registration process. For example, the CD provides a flag in its registration. The flag indicates whether the infrastructure and the CD are type I, meaning that they do not support SDB, or type II, meaning that they both support SDB. The CD may learn the infrastructure's type during registration process, e.g., via the P-REV parameter in CDMA registration.

[0043] In this embodiment, the group communication server determines that the originator is operating on type I infrastructure, which does not support SDB messaging. The group communication server employs optimistic group communication setup strategy, where the group communication server determines whether the targets are registered in the group communication system. In step **414**, after the group

communication server has determined that at least one of the targets is registered, the group communication server sends a "floor grant" message to the originator's CD.

[0044] The originator's CD sends a "floor granted" message to the originator, in step **416**, indicating that the requested group communication session has been established, floor has been granted and the originator start delivering media, e.g., start talking. If, at this time, the originator has released the PTT button, the originator may press PTT button again to start delivering media, e.g., start talking. The originator's CD also sends an "ACK" message to the group communication server, in step **418**, acknowledging the receipt of the "floor grant" message.

[0045] In one embodiment, the originator's CD receives media delivered by the originator, in step **420**, and buffers the received media, in step **422**, for transmission to the group communication server after the traffic channels of the target CDs have been re-established.

[0046] The group communication server, after identifying the targets in step **412**, sends "announcements" messages, in step **424**, to the infrastructures supporting the target CDs, to trigger re-origination of the traffic channels for the target CDs. In one embodiment, the group communication server sends the "announcements" messages to the IP address associated with each target. Each infrastructure, e.g., PDSN/CDMA, recognizes the corresponding target's traffic channels is in the dormant state, so the infrastructure starts the process of re-originating the corresponding traffic channel in order to deliver the "announcement" message thereto. The target CDs' infrastructures start re-originating the targets' traffic channels, in step **426**. After the traffic channels of the target CDs are up, in step **428**, and at least one target has accepted to receive media from the originator, in step **430**, the group communication server sends a media grant message, in step **432**, to the originator's CD.

[0047] After receiving the "media grant" message from the group communication server, the originator's CD starts transferring media, which may have been buffered in step **422**, to the group communication server, in step **434**. The group communication server then transmits, in step **436**, the received media to the target CDs that have active traffic channel. In this embodiment, the PTT latency for optimistic setup strategy is impacted by the traffic channel re-origination time for the originator, since the group communication server does not need to contact the targets prior to granting permission to the originator to start delivering media.

[0048] FIG. 5 illustrates a flow diagram showing a process for providing a group communication set up strategy, according to one embodiment. The originator's CD receives an indication from the originator for setting up a session to communicate media to one or a group of targets, in step **502**. In this embodiment, the originator is operating on type I infrastructure, which does not support SDB messaging. Therefore, the originator's CD may need to set up its traffic channel prior to sending a message to the group communication server. Upon receiving the indication from the originator, the originator's CD starts the process of traffic channel re-origination, in step **504**, and waits until the traffic channel for the originator is up, in step **506**.

[0049] The originator's CD then sends a "floor request" message, in step **508**, to the group communication server for floor control. The group communication server sends an "ACK request" to the originator's CD, in step **510**, acknowledging the receipt of the floor request. The group communication server then performs group communication setup tasks, in step **512**, including identifying the targets, locating the targets, determining the types of infrastructures the originator and the targets are operating on, and determining whether the targets are registered in the group communication system and/or whether at least one target accepts to receive media.

[0050] In this embodiment, the group communication server determines that the originator is operating on type I infrastructure, which does not support SDB messaging. The group communication server employs guaranteed group communication setup strategy, where the group communication server determines whether at least one target will accept to receive media. Accordingly, the group communication server sends announcements, in step **524**, to the infrastructures supporting the target CDs, to trigger re-origination of the traffic channels for the target CDs. The target CDs' infrastructures start re-originating the targets' traffic channels, in step **526**.

[0051] After the traffic channels of the target CDs are up, in step **528**, and at least one target has accepted to receive media from the originator, in step **530**, the group communication server sends a "floor grant" message, in step **514**, to the originator's CD. The Originator's CD sends a "floor granted" message to the originator, in step **516**, indicating that the requested group communication session has been established, floor has been granted and the originator may start delivering media, e.g., start talking. If, at this time, the originator has released the PTT button, the originator may press PTT button again to start delivering media, e.g., start talking. The Originator's CD also

sends an "ACK" message to the group communication server, in step **518**, acknowledging the receipt of the "floor grant" message.

[0052] In one embodiment, the originator's CD receives media delivered by the originator, in step **520**, and buffers the received media in step **522** for transmission to the group communication server, after receiving order from the group communication server.

[0053] After receiving "media grant" message, in step **532**, from the group communication server, the originator's CD starts transferring media, which may have been buffered as in step **522**, to the group communication server. The group communication server then transmits, in step **536**, the received media to the target CDs that have active traffic channel.

[0054] In this embodiment, the PTT latency for optimistic setup strategy is impacted by the traffic channel re-origination time for the originator and the targets, since the group communication server contacts the targets prior to granting permission to the originator to start delivering media. Therefore, the PTT latency is longer than the PTT latency for the embodiment described above in connection with FIG. 4.

[0055] FIG. 6 illustrates a flow diagram showing a process for providing a group media communication setup strategy, according to one embodiment. The originator's CD receives an indication for setting up a session to communicate media to one or a group of targets, in step **602**. In this embodiment, the originator is operating on type II infrastructure, which supports SDB messaging. Therefore, the originator's CD does not need to wait for its traffic channel to be set up before being able to send or receive messages. Upon receiving the indication from the originator, the originator's CD starts the process of traffic channel re-origination, in step **604**, but does not need to wait until the traffic channel for the originator's infrastructure is up, in step **406**, before being able to send or receive messages to or from the group communication server. In one embodiment, the originator's CD sends such messages in SDB form, as discussed above.

[0056] The originator's CD, sends a "floor request" message, in step **608**, via SDB, to the group communication server for floor control. The group communication server sends an "ACK request" message to the originator's CD, in step **610**, via SDB, acknowledging the receipt of the floor request. The group communication server then performs group communication setup tasks, in step **612**, including identifying the targets, locating the targets, determining the types of infrastructures the originator and

the targets are operating on, and determining whether the targets are registered in the group communication system and/or whether at least one target accepts to receive media.

[0057] In this embodiment, the group communication server determines that the originator and the targets are operating on type II infrastructures, which support SDB messaging. The group communication server employs optimistic group communication setup strategy, where the group communication server determines whether the targets are registered in the group communication system. In step **614**, after the group communication server has determined that at least one of the targets is registered, the group communication server sends a "floor grant" message, via SDB, to the originator's CD. The originator's CD sends a "floor granted" message, in step **616**, indicating that the requested group communication session has been established, floor has been granted, and the originator may start delivering media, e.g., start talking. If the originator has released the PTT, the originator may press PTT again to start delivering media, e.g., start talking. The originator's CD also sends an "ACK" message, via SDB, to the group communication server, in step **618**, acknowledging the receipt of the "floor grant" message.

[0058] In one embodiment, the originator's CD receives media delivered by the originator, in step **620**, and buffers the received media, in step **622**, for transmission to the group communication server, after the traffic channels of the originator's CD is re-established.

[0059] After identifying and locating the targets, the group communication server sends announcements, in step **624**, to the target CDs' infrastructures to inform them of an upcoming media communication. The announcement may be sent via SDB. The target CDs' infrastructures start re-originating their traffic channels, in step **626**. After the group communication server receives at least one acceptance message from the originator, in step **628**, via SDB, the group communication server sends a "media grant" message, in step **630**, via SDB or traffic channel, to the originator's CD.

[0060] After the traffic channel of the originator's CD is up, in step **606**, the originator's CD starts transferring media, which may have been buffered in step **622**, to the group communication server. The group communication server may also buffer the received media, in step **632**, for transmission to the targets, after the traffic channels of the targets are re-established. After receiving an indication that the traffic channels of the targets

are re-established, in step **636**, the group communication server then transmits, in step **638**, the received media to the target CDs that have active traffic channel.

[0061] In this embodiment, the PTT latency for optimistic setup strategy is not impacted by the traffic channel re-origination time for the originator, since the group communication server does not need to wait for the originator's traffic channel re-origination prior to being able to send messages to the group communication server. Therefore, the PTT latency is shorter than the PTT latency for the embodiment described above in connection with FIG. 4.

[0062] FIG. 7 illustrates a flow diagram showing a process for providing a group communication setup strategy, according to one embodiment. The originator's CD receives an indication for setting up a session to communicate media to one or a group of targets, in step **702**. The originator's CD starts the process of traffic channel re-origination, in step **704**, but does not need to wait until the traffic channel for the originator's infrastructure is up, in step **706**, before being able to send or receive messages to or from the group communication server. In one embodiment, the originator's CD sends such messages in SDB form, as discussed above.

[0063] The originator's CD, sends a "floor request," in step **708**, via SDB, to the group communication server for floor control. The group communication server sends an "ACK request" to the originator's CD, in step **710**, via SDB, acknowledging the receipt of the floor request. The group communication server performs group communication setup tasks, in step **712**, including identifying the targets, locating the targets, determining the types of infrastructures the originator and the targets are operating on, and determining whether the targets are registered and/or whether at least one target accepts to receive media.

[0064] In this embodiment, the group communication server determines that the originator and the targets are operating on type II infrastructure, which supports SDB messaging as discussed above. The group communication server employs guaranteed call set up strategy, where the group communication server determines whether at least one target will accept to receive media from the originator. Therefore, the group communication server sends announcements, in step **724**, to the target CDs to inform them of an upcoming media communication. The announcement may be sent via SDB. After the group communication server receives at least one acceptance message from the originator, in step **728**, via SDB, the group communication server sends a "floor grant" message, in step **714**, via SDB, to the originator's CD.

[0065] The originator's CD sends a "floor granted" message to the originator, in step **716**, indicating that the requested group communication session has been established, floor has been granted and the originator may start delivering media, e.g., start talking. The originator's CD also sends an "ACK" message via SDB to the group communication server, in step **718**, acknowledging the receipt of the floor grant message.

[0066] In one embodiment, the originator's CD receives media delivered by the originator, in step **720**, and buffers the received media, in step **722**, for transmission to the group communication server, after the traffic channels of the originator's is re-established.

[0067] After receiving the ACK message, in step **718**, the group communication server sends a "media grant" message, via SDB or traffic channel, in step **730**, to the originator's CD. After the traffic channel of the originator's CD is up, in step **706**, the originator's CD starts transferring media that may have been buffered as in step **722**, to the group communication server, in step **732**. The group communication server may also buffer the received media, in step **734**, for transmission to the targets, after the traffic channels of the targets are re-established. After the traffic channels of the targets are re-established, in step **736**, the group communication server then transmits, in step **738**, the received media to the target CDs that have active traffic channel.

[0068] In this embodiment, the PTT latency for guaranteed setup strategy is not impacted by the traffic channel re-origination time for the originator and the targets, since the group communication server does not need to wait for the traffic channel re-origination prior to being able to send or receive messages to or from the CDs. Therefore, the PTT latency is shorter than the PTT latency for the embodiment described above in connection with FIG. 4, but longer than the PTT latency for the embodiment described above in connection with FIG. 6. Consequently, based on the types of the originator and the targets' infrastructures, either optimistic or guaranteed setup strategy may be selectively chosen to provide a uniform setup experience for a group of users operating on diverse infrastructures.

[0069] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and protocols. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents,

electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0070] Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[0071] The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but, in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0072] The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor, such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC

may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

[0073] The description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments may be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments, e.g., in an instant messaging service or any general wireless data communication applications, without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein. The word "exemplary" is used exclusively herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.